



## Goddard Procedural Requirements (GPR)

<b>DIRECTIVE NO.</b>	<u>GPR 1840.2B</u>	<b>APPROVED BY Signature:</b>	<u>Original Signed By</u>
<b>EFFECTIVE DATE:</b>	<u>February 27, 2012</u>	<b>NAME:</b>	<u>Judith N. Bruner</u>
<b>EXPIRATION DATE:</b>	<u>February 27, 2017</u>	<b>TITLE:</b>	<u>Director, Safety and Mission Assurance</u>

### COMPLIANCE IS MANDATORY

**Responsible Office:** 350/Occupational Safety and Health (OS&H) Division

**Title:** Industrial Hygiene Program

## PREFACE

### P.1 PURPOSE

This directive defines the requirements for the implementation and management of the Industrial Hygiene (IH) Program at the Goddard Space Flight Center (GSFC). The purpose of the IH program is to support the GSFC Occupational Health Program and NASA Policy Directive (NPD) 1800.2 by anticipating, recognizing, evaluating, and controlling actual and potential occupational health and safety hazards and environmental factors that may affect the health, comfort, or productivity of GSFC's community.

### P.2 APPLICABILITY

This directive applies to all GSFC personnel, facilities, and activities, including all permanent and temporary sites. This directive shall also apply to all GSFC tenant organizations, contractors, grantees, clubs and other persons operating under the auspices of GSFC, or on GSFC property, as required by law, and as directed by contractual, grant, and agreement documents.

### P.3 AUTHORITY

- NPD 1800.2, NASA Occupational Health Program; and
- NPR 1800.1, NASA Occupational Health Program Procedures.

### P.4 APPLICABLE DOCUMENTS

- 29 CFR 1910.132, Occupational Safety and Health Administration (OSHA) Personal Protective Equipment (PPE) General Requirements;
- 29 CFR 1910.95, OSHA Occupational Noise Exposure;
- 29 CFR 1910.134, OSHA Respiratory Protection;
- 29 CFR 1910.1000, OSHA Table Z-1 Limits for Air Contaminants;
- 29 CFR 1910.1200, OSHA Hazard Communication;
- 29 CFR 1910.1450, OSHA Occupational Exposure to Hazardous Chemicals in Laboratories;
- NPR 1441.1, NASA Records Retention Schedules;
- GPR 1700.2, Chemical Hygiene Program;
- GPR 1700.8, GSFC Hazard Communication Program;

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<b>DIRECTIVE NO.</b>	<u>GPR 1840.2B</u>
<b>EFFECTIVE DATE:</b>	<u>February 27, 2012</u>
<b>EXPIRATION DATE:</b>	<u>February 27, 2017</u>

- j. GPR 1820.1, Hearing Conservation Program;
- k. GPR 1820.2, Respiratory Protection Program;
- l. GPR 1840.1, Asbestos Management Program;
- m. GPR 8621.4, GSFC Mishap Preparedness and Contingency Plan;
- n. GSFC Form 23-60, Job Hazard Analysis (JHA) Worksheet; and
- o. American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs<sup>®</sup>) and Biological Exposure Indices (BEIs<sup>®</sup>).

## **P.5 CANCELLATION**

- a. GPR 1840.2A, Industrial Hygiene Program

## **P.6 SAFETY**

All personnel who perform surveys in conjunction with this document will comply with all worksite safety and health requirements, including procedures and hazard controls required for use by workers.

## **P.7 TRAINING**

Occupational Safety & Health (OS&H) Division civil service employees and contractors shall receive information and training on the hazards to which they may be exposed and the means of protection during the performance of IH surveys.

- a. Training for OS&H Division industrial hygiene contractors will be determined and provided by the IH contractor's Team Leader; and
- b. OS&H Division civil service Industrial Hygienists shall have demonstrated competence in recognizing potential health hazards through certification and experience, in fulfillment of the position description.

See also Section 3.

## P.8 RECORDS

Record Title	Record Custodian	Retention
<b>Employee Exposure Summaries</b> Civil service employee exposure summaries shall be maintained in conjunction with the employee's medical records.	Medical and Environmental Management Division (MEMD), (Health Unit)	<u>NRRS 1/127B*</u> Thirty days after separation, transfer to National Personnel Records Center (NPRC), St. Louis, MO. NPRC will destroy 75 years after birth date, 60 years after date of the earliest document in the folder if the date of birth cannot be ascertained, or 30 years after latest separation, whichever is later.
<b>Similar Exposure Group (SEG) potential exposure records</b> Records of groups of persons who experience similar exposures, so that an exposure to any member of the group is representative of that of all members of the group.	OS&H Division, Industrial Hygiene Office (IHO)	NRRS 1/127B*
<b>Industrial Hygiene (IH) Baseline and Follow-up Survey Reports</b>	OS&H Division, IHO	NRRS 1/127B*
<b>IH Request-based Survey Reports</b> IH survey reports will be maintained for all IH activities performed at GSFC (e.g. facility walk through inspections, ergonomic, noise, heat stress, and local/general ventilation surveys, employee complaint and exposure incident investigations and emergency response reports.)	OS&H Division, IHO	<u>NRRS*1/124</u> - Retire to Federal Records Center (FRC) when 3 years old. Destroy when 10 years old.
<b>Training Records</b>	Managers and Supervisors	<u>NRRS 3/33G1</u> - Destroy 5 years after employee discontinues or completes training.

\*NRRS – NASA Records Retention Schedules ([NPR 1441.1](#))

## **P.9 MEASUREMENT/VERIFICATION**

The IHO shall maintain statistics on the performance of the IH program. The statistics shall be compiled, reviewed, and reported annually to the OS&H Division Chief. These statistics shall include, but are not limited to:

- a. Number of comprehensive baseline and follow up surveys conducted;
- b. Number of request-based surveys (indoor air quality, ergonomics, noise, personal protective equipment (PPE), consultative/chemical exposure) conducted;
- c. Number of samples (asbestos, lead, mold, metals, dusts, organic vapors, etc.) analyzed;
- d. Number of comprehensive and request-based (indoor air quality, ergonomics, noise, PPE, consultative/chemical exposure) surveys performed in relation to the number of surveys scheduled or requested;
- e. Percentage of high hazard operations or areas receiving annual follow up surveys;
- f. Number of local exhaust ventilation surveys conducted in relation to the number scheduled;
- g. Number of civil service employees receiving training (respiratory protection, hearing conservation, asbestos awareness) in relation to the number of civil service employees required to receive training;
- h. Average response time from survey request to evaluation and from survey request to verbal/written report;
- i. Average report time from onsite evaluation or sample collection (asbestos, mold, organic vapor) to written report;
- j. Percentage of asbestos and lead abatement submittals that are either approved or rejected within 3 working days;
- k. Percentage of customer satisfaction evaluations for training classes presented and surveys performed ranking above average to excellent in relation to total number of evaluations;

## **PROCEDURES**

In this document, a requirement is identified by “shall,” a good practice by “should,” permission by “may” or “can,” expectation by “will,” and descriptive material by “is.”

### **1. RESPONSIBILITIES**

#### **1.1 The Center Director will ensure that:**

- a. A safe and healthful workplace is provided for all GSFC personnel; and
- b. All recognized hazards are controlled to the greatest possible extent.

#### **1.2 Directors of shall:**

- a. Ensure that job hazard analyses (JHAs) and process hazard analyses (PHAs) are developed for all operations with potential occupational health hazards, and reviewed annually and updated as needed;

<b>DIRECTIVE NO.</b>	<u>GPR 1840.2B</u>
<b>EFFECTIVE DATE:</b>	<u>February 27, 2012</u>
<b>EXPIRATION DATE:</b>	<u>February 27, 2017</u>

in accordance with GPR 1700.1 Occupational Safety Program at Goddard Space Flight Center and GPR 1700.2 Chemical Hygiene Program;

- b. Ensure that written directives (e.g. Work Instructions) and procedures implemented for controlling potential occupational health hazards are reviewed and updated every five years in accordance with GPR 1410.1 Directives Management;
- c. Ensure that directorate requirements governing the maintenance of Material Safety Data Sheets (MSDS) in the GSFC MSDS database system are in place; and
- d. Ensure that directorate procedures are in place for reviewing design and modification packages for systems involving the use, storage, or processing of hazardous materials or which have the potential to expose civil service employees and contractors to chemical, biological, or physical agents.

### **1.3 OS&H (Occupational Safety & Health) Division shall:**

- a. Maintain and provide management oversight of the IH program in accordance with NPD 1800.2 and NPR 1800.1; and
- b. Develop and implement methods (support agreements, contracts, etc.) to augment the IH program where required or where necessary personnel are not assigned.

### **1.4 The MEMD (Medical and Environmental Management Division) Health Unit shall:**

Perform medical evaluations and surveillance for civil service employees enrolled in medical surveillance or PPE programs in accordance with NPD 1800.2.

### **1.5 The IHO (Industrial Hygiene Office) shall:**

- a. Perform routine comprehensive baseline and follow-up IH surveys of GSFC organizations and facilities in order to identify potential occupational health hazards;
- b. Conduct health hazard evaluations (HHE) of operations having the potential for occupational health hazards, as described in this GPR;
- c. Conduct hazard assessments to determine recommended and required PPE for operations and processes associated with potential occupational health hazards in each code, laboratory, or shop, in accordance with OSHA 29 CFR 1910.132;
- d. Perform request-based surveys to evaluate potential occupational health hazards due to chemical, physical, and biological agents, including concerns related to asbestos, lead, noise, thermal stressors, indoor air quality, and ergonomics;
- e. Evaluate personal exposure levels of civil service employees to chemical, physical, and biological agents, as necessary;
- f. Identify civil service employees required to participate in IH programs or receive training in IH related topics;
- g. Identify contractor support organization compliance with GSFC IH programs, and assist contractors in identifying personnel required to participate in IH programs;
- h. Administer IH programs including, but not limited to, the Hearing Conservation Program and Respiratory Protection Program, for civil service employees required to be included in such programs, per OSHA 29 CFR 1910.95 and 1910.134;

<b>DIRECTIVE NO.</b>	<u>GPR 1840.2B</u>
<b>EFFECTIVE DATE:</b>	<u>February 27, 2012</u>
<b>EXPIRATION DATE:</b>	<u>February 27, 2017</u>

- i. Provide technical assistance in the development of training courses related to IH matters;
- j. Provide managers and supervisors, and other affected employees or responsible safety organizations:
  - (1) Results of IH surveys with findings, recommendations, and action items;
  - (2) Results of HHEs and hazard assessments;
  - (3) Recommended methods for the elimination or control of occupational health hazards;
  - (4) Requirements for employees to participate in medical monitoring programs upon their consent; and
  - (5) Requirements for compliance with applicable OSHA, State, NASA, and GSFC regulations and requirements;
- k. Investigate incidents involving occupational exposure to health hazards and referrals from other functions such as the Health Unit or Occupational Safety;
- l. Review facility plans, modifications, projects and operational procedures to assess the adequacy of precautions taken to control hazards;
- m. Provide technical assistance in the design and implementation of engineering controls, work practices, and selection of PPE when requested;
- n. Survey and certify the effectiveness of local exhaust ventilation systems;
- o. Participate in Directorate and Center Safety Council meetings, contractor safety forums, and other safety meetings; presenting on the status of IH programs and matters as necessary;
- p. Provide periodic reports to the OS&H Division Chief. These reports include, but are not limited to, monthly and annual program status reports, and annual program audit and metrics reports;
- q. Provide IH program policy and Headquarters audit support to the Wallops Flight Facility (WFF) Safety Office;
- r. Provide annual respiratory protection training and respiratory fit testing for WFF civil servants;
- s. Provide IH support during emergency exercises, launch activities, and specific projects to the WFF Safety Office, as resources permit; and
- t. Loan equipment and arrange for analytical support services for samples collected at WFF up to 10% of the sample analysis budget.

#### **1.6 Wallops Flight Facility (WFF) Safety Office IH shall:**

- a. Perform all IH functions required in this and other applicable IH GPRs at WFF, except where otherwise stated;
- b. Provide representation for various functional groups such as the GSFC Occupational Health Working Group and GSFC Asbestos Working Group;
- c. Maintain annual metrics for elements P.9 a, f., and k.;
- d. Communicate IH concerns to the OS&H Division as necessary; and
- e. Obtain technical assistance, equipment, and analytical services through the OS&H Division as necessary.

#### **1.7 The Procurement Operations Division shall:**

Include, in any contract, the requirement that contractors provide their employees with relevant safety and health information and training.

<b>DIRECTIVE NO.</b>	<u>GPR 1840.2B</u>
<b>EFFECTIVE DATE:</b>	<u>February 27, 2012</u>
<b>EXPIRATION DATE:</b>	<u>February 27, 2017</u>

## 1.8 Managers and Supervisors shall:

- a. Conduct periodic workplace inspections and review operations/procedures in conjunction with affected civil service employees and contractors to identify hazardous materials and physical agents;
- b. Ensure that JHAs and PHAs are reviewed and updated annually to reflect actual hazards and to prevent or otherwise reduce exposure;
- c. Ensure that any mishap, close call, injury, or illness resulting from an occupational health hazard is reported to the NASA Incident Reporting Information System (IRIS) in accordance with GPR 8621.4;
- d. Ensure that any MSDSs for chemical substances not procured through GSFC's hazardous material management system are submitted to the Information Logistics Management Division for inclusion in the hazardous material management system, or are maintained in hard copy form until such inclusion to comply with OSHA 29 CFR 1910.1200 and GPR 1700.8;
- e. Ensure that written procedures and analyses (e.g. job hazard analyses (JHAs) using GSFC Form 23-60, process hazard analyses (PHAs) per GPR 1700.2) have been developed for operations involving the use of hazardous materials and physical agents. Written procedures shall identify all hazards associated with an operation and describe controls for mitigating the hazard, as defined in section 2.5 of this document;
- f. Ensure that all civil service employees and contractor employees are aware of hazardous materials and physical agents in their work area, understand the requirements for working safely with these materials and agents, and know what actions to take in an emergency, e.g. chemical spill or release;
- g. Contact the IHO for determining proper procedures or requirements related to the following:
  - (1) Operations in which hazardous chemicals are used or generated;
  - (2) Construction or demolition projects in which suspected asbestos-containing materials or lead-containing paints may be present;
  - (3) Work in confined spaces;
  - (4) Operations involving excessive exposure to heat, vibration, or noise;
  - (5) Work involving potential ergonomic hazards; and
  - (6) Operations involving biological hazards.
- h. Coordinate the scheduling of IH surveys and HHEs;
- i. Ensure that the results of HHEs are provided to affected civil service employees;
- j. Ensure that corrective actions are taken and that hazard controls are implemented as a result of IH surveys, JHAs, PHAs, and HHEs;
- k. Contact GSFC's IHO within 30 days of planned new operations or changes to existing operations, processes, or hazardous materials, so that any newly introduced health hazards may be assessed;
- l. Ensure the proper operation of engineering controls;
- m. Ensure that civil service employees and contractors are notified of any modifications to procedures or systems used to control occupational exposures to health hazards;
- n. Ensure that civil service employees and contractors with signs or symptoms of exposure to occupational health hazards report to their responsible occupational health service provider;
- o. Ensure that civil service employees and contractors are provided information and training in the identification of occupational health hazards in their workplaces and protective measures required for their safety; and
- p. Ensure that civil service employees have received required training as determined by the IHO.



## **1.9 Employees shall:**

- a. Perform work in a safe manner consistent with the guidance provided to them;
- b. Notify supervisors of areas, operations, or equipment that may be a source of chemical or physical hazards;
- c. Report signs or symptoms of exposure to a health hazard to the supervisor and the responsible occupational health service provider;
- d. Use, maintain, and store PPE as required;
- e. Participate in workplace audits, hazard evaluations, and the development of written procedures and analyses;
- f. Complete all safety and health training requirements; and
- g. Have the right to decline participation in medical surveillance programs, however such a declination may result in exclusion from performing certain work functions.

## **2. GENERAL PROVISIONS**

### **2.1 Applicable Exposure Limits**

Occupational exposure limits (OEL) set by OSHA in 29 CFR 1910.1000, the ACGIH or NASA, whichever is most stringent, shall be used to evaluate occupational hazards. Other sources of exposure limits may include the National Institute for Occupational Safety and Health (NIOSH), American National Standards Institute (ANSI), American Industrial Hygiene Association (AIHA), or chemical manufacturers.

### **2.2 Comprehensive Baseline and Follow-up Surveys**

Comprehensive baseline and follow up IH surveys shall be conducted by the IHO for all codes at GSFC to establish baseline exposure levels to occupational health hazards; identify hazardous operations; characterize operations, processes and related employee exposure; evaluate health hazards; identify health hazard controls; form SEGs; and track operations for changes in processes and exposures.

- a. Surveys of new or modified operations shall be conducted within 30 days of receiving notification from managers or supervisors.
- b. The frequency of follow up surveys shall correspond to the health risk assessment rating assigned by the IHO as follow:
  - (1) Operations assigned a high risk assessment rating shall receive an annual follow up survey;
  - (2) Operations assigned a medium risk assessment rating shall receive a follow up survey every 2 years; and
  - (3) Operations assigned a low risk assessment rating shall receive a follow up survey every 3 years.



### 2.3. Initial Hazard Assessment

- a. A hazard assessment shall be initiated as a result of:
  - (1) Surveys of workplaces by the OS&H Division that identify potential health hazards;
  - (2) Reviews of the hazardous material management system;
  - (3) Reviews of procedures or operations by the IHO to identify hazardous materials or physical agents; and
  - (4) Investigations of complaints of reported work-related illness, injury, or potential health hazards by the OS&H Division.
- b. The initial assessment shall be aimed at gathering data to:
  - (1) Support the HHE;
  - (2) Eliminate the hazard and the need for further HHEs; and
  - (3) Recommend interim hazard control measures while permanent controls are designed and implemented; and
- c. HHEs shall be conducted where there is a reasonable potential for civil service employee exposure to the hazardous material or condition. Supervisors shall consult the IHO to determine the need for the evaluation.

### 2.4. Health Hazard Evaluation (HHE)

HHEs shall be performed to evaluate, monitor, and document civil service employee exposures to hazardous materials or physical agents. HHEs shall comply with the minimum requirements established below:

- a. HHEs will be performed for the following chemical, physical, and biological agents:
  - (1) Those that have specific OSHA standards;
  - (2) Confirmed and probable carcinogens (according to recognized authorities such as the International Agency for Research on Cancer, National Toxicology Program, EPA, OSHA, ACGIH) if contents are greater than 0.1% of the product;
  - (3) Possible human carcinogens based on animal studies if contents are greater than 50%;
  - (4) Reproductive/developmental hazards indicated on NIOSH list and Navy list of developmental and reproductive hazards;
  - (5) Extreme toxicants that have low IDLH values (<10 parts per million (ppm)), low exposure limits (<1 ppm as an 8-hr TWA), are allergic sensitizers, or upon the judgment of the IH.
- b. HHE sampling strategy shall incorporate appropriate sampling and analytical methods and be developed to measure civil service employee exposure levels against applicable exposure limits defined in Section 2.1;
- c. Civil service employee exposure monitoring shall characterize exposure for the SEG. This representative exposure data for similarly exposed personnel will be provided to the Health Unit;
- d. Affected civil service employees shall be notified of all monitoring results, in writing, within 15 working days of the IHO receiving the results;

<b>DIRECTIVE NO.</b>	<u>GPR 1840.2B</u>
<b>EFFECTIVE DATE:</b>	<u>February 27, 2012</u>
<b>EXPIRATION DATE:</b>	<u>February 27, 2017</u>

- e. If civil service employee exposure is above the applicable exposure limit or action level, the IHO shall inform the employee of the corrective actions being taken (i.e., changes to engineering controls, work practices, etc.);
- f. Civil service employees with exposures at or greater than the action level shall be identified and arrangements shall be made for periodic medical surveillance with the Health Unit, upon employee consent (declined participation may result in exclusion from performing certain work functions);
- g. HHEs shall reflect civil service employee exposure during operations as they are normally performed; and
- h. Follow up HHEs shall be performed to assess exposure conditions after any modifications that may increase employee exposure, and after the implementation of hazard control measures.

## 2.5. Health Hazard Controls

Health hazard controls shall be implemented, to the extent feasible, to eliminate or reduce exposure to occupational hazards. Engineering, work practice, and administrative controls are the primary means of reducing exposure to occupational hazards. PPE shall be considered after it has been determined that engineering, work practice, and administrative controls are not sufficient to achieve acceptable limits of exposure.

- a. Engineering controls shall include those controls that remove or isolate the hazard from the work environment. Engineering controls shall include eliminating the use of hazardous chemicals; substituting chemicals, materials, equipment, and processes with less hazardous ones; isolating the worker from the operation; enclosing or confining work processes; and installing general and local exhaust ventilation systems.
- b. Work practice controls shall include:
  - (1) Implementing procedures that minimize exposure to hazards by altering the manner in which an operation is performed;
  - (2) Inspecting and maintaining process and control equipment on a regular basis;
  - (3) Implementing good housekeeping procedures;
  - (4) Prohibiting eating, drinking, smoking, chewing tobacco, and applying cosmetics in regulated areas.
- c. Administrative controls shall include scheduling operations and setting work schedules in a manner that minimizes the number of workers and the duration of worker exposure to occupational health hazards, e.g. job rotation or scheduling high hazard operations for periods when the fewest employees are present.
- d. PPE shall be used when effective engineering, work practice, and administrative controls are **not** feasible or while such controls are being instituted. Examples of PPE include gloves, safety glasses, chemical splash goggles, face shields, ear plugs, helmets, safety shoes, protective suits, and respirators. To be effective, PPE must be individually selected, properly fitted, properly worn, regularly cleaned and maintained, stored in a sanitary manner, and replaced as necessary.

### **3. PROVISIONS FOR SPECIFIC IH PROGRAM FUNCTIONS**

Civil service employees shall participate in IH programs and training if during a survey or HHE, the IHO identifies employees required for inclusion. Supervisors and civil service employees shall be notified by the IHO if they are required to participate in these programs. IH programs and training include, but are not limited to, the Respiratory Protection Program (GPR 1820.2, NPR 1800.1, 29 CFR 1910.134), Hearing Conservation Program (GPR 1820.1, NPR 1800.1, 29 CFR 1910.95), Hazard Communication Program (GPR 1700.8, 29 CFR 1910.1200), Chemical Hygiene Program (GPR 1700.2, 29 CFR 1910.1450), and Asbestos Awareness Training (GPR1840.1).

## Appendix A – Definitions

- A.1 Action level** - the exposure level at which OSHA or other occupational exposure regulations take effect. This is generally one half of the occupational exposure limit (OEL) or OSHA permissible exposure limit (PEL) for a specific substance;
- A.2 Biological agent / hazard** – a biological pathogen that may cause illness. Examples include bacteria (foodborne pathogens), viruses (bloodborne pathogens), and fungi (mold);
- A.3 Chemical agent / hazard** - a chemical substance that may cause illness or injury;
- A.4 Contractor** - any entity that performs services at or on behalf of GSFC, including prime contractors and subcontractors;
- A.5 Hazardous material** – any chemical or biological substance that may cause health hazards as a result of exposure. A hazardous material may be radioactive, flammable, explosive, toxic, corrosive, biohazardous, an oxidizer, an asphyxiant, an allergen, or may have other characteristics that make it hazardous in specific circumstances;
- A.6 Health hazard evaluation (HHE)** – an evaluation of an individual’s or a group of individuals’ exposure to a chemical, physical, or biological agent, to characterize and assess the health risk of that agent;
- A.7 High risk assessment rating** – a health risk rating given to an operation when potential exposure to chemical, biological, or physical agents used or generated will likely result in a high score of combined severity and probability of health effects or produce an exposure that is:
- (1) greater than the action level under normal use;
  - (2) greater than one-half of the action level for confirmed or probable human carcinogens, under normal use;
  - (3) greater than one-half of the action level for extreme toxicants and sensitizers, under normal use;
  - (4) greater than 50% of the immediately dangerous to life and health threshold in the event of a release or spill;
  - (5) greater than 50% of the lower explosive limit in the event of a release or spill; or
  - (6) less than 16% oxygen in the event of a release or spill, and the oxygen deficiency hazard (ODH) classification is “1”.
- A.8 Immediately dangerous to life and health** - an atmospheric concentration of any toxic, corrosive or asphyxiates substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere;
- A.9 Low risk assessment rating** – a health risk rating given to an operation when potential exposure to chemical, biological, or physical agents used or generated will likely result in a low score of combined severity and probability of health effects or produce an exposure that is:
- (1) less than 10% of exposure limits under normal use;
  - (2) less than the detection limit for confirmed or probable human carcinogens, under normal use;
  - (3) less than the detection limit for extreme toxicants and sensitizers, under normal use;
  - (4) less than one-half of the immediately dangerous to life and health threshold in the event of a release or spill;
  - (5) less than 10% of the lower explosive limit in the event of a release or spill; and

(6) greater than 19.5% oxygen in the event of a release or spill.

**A.10 Medium risk assessment rating** – a health risk rating given to an operation when potential exposure to chemical, biological, or physical agents used or generated will likely result in a medium score of combined severity and probability of health effects or produce an exposure that is:

(1) greater than 10% of the exposure limit and less than the action level under normal use;

(2) greater than the detection limit but less than one-half of the action level for confirmed or probable human carcinogens, under normal use;

(3) greater than the detection limit but less than one-half of the action level for extreme toxicants and sensitizers, under normal use;

(4) between 10% to 50% of the immediately dangerous to life and health threshold in the event of a release or spill;

(5) between 10% to 50% of the lower explosive limit in the event of a release or spill; or

(6) greater than 16% but less than 19.5% oxygen in the event of a release or spill, and the ODH classification is either “0” or “none”.

**A.11 Occupational exposure limit (OEL)** - the airborne concentration of a substance that a worker may be exposed to, as determined by recognized authorities, including OSHA PELs; American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLV), specific NASA or GSFC Standards, National Institute for Occupational Safety & Health (NIOSH) recommended exposure limits (REL), and others referenced in NPR 1800.1;

**A.12 Oxygen deficiency hazard (ODH) classification** – rating given to a cryogenic or other operation with the potential of creating an oxygen deficient atmosphere. The ratings of 1, 0, and none are arrived at using a calculation worksheet available on the safety1st website.

**A.13 Permissible exposure limit (PEL)** - the airborne concentration of a substance that a worker may be exposed to under OSHA regulations, 29 CFR 1910.1000. PELs are based on an 8-hour time-weighted average (TWA) exposure;

**A.14 Physical agent** – a source of energy that may cause injury or disease. Examples include noise, vibration, radiation, and extremes in temperature and pressure; and

**A.15 Similar exposure group (SEG)** - a group of individuals having similar exposures to chemical, physical, or biological agents for a given work process, and for which medical surveillance may be required.

## Appendix B – Acronyms

<b>ACGIH</b>	American Conference of Governmental Industrial Hygienists
<b>AIHA</b>	American Industrial Hygiene Association
<b>ANSI</b>	American National Standards Institute
<b>BEI</b>	Biological Exposure Index
<b>CFR</b>	Code of Federal Regulations
<b>FRC</b>	Federal Records Center
<b>GPR</b>	Goddard Procedural Requirements
<b>GSFC</b>	Goddard Space Flight Center
<b>HHE</b>	Health Hazard Evaluations
<b>IH</b>	Industrial Hygiene
<b>IHO</b>	Industrial Hygiene Office
<b>IRIS</b>	Incident Reporting Information System
<b>JHA</b>	Job Hazard Analysis
<b>MEMD</b>	Medical and Environmental Management Division
<b>MSDS</b>	Material Safety Data Sheet
<b>NASA</b>	National Aeronautics and Space Administration
<b>NIOSH</b>	National Institute for Occupational Safety and Health
<b>NPD</b>	NASA Policy Directive
<b>NPR</b>	NASA Procedural Requirements
<b>NPRC</b>	National Personnel Records Center
<b>NRRS</b>	NASA Records Retention Schedules
<b>ODH</b>	Oxygen Deficiency Hazard
<b>OSHA</b>	Occupational Safety and Health Administration
<b>OS&amp;H</b>	Occupational Safety and Health Division
<b>PEL</b>	Permissible Exposure Limit
<b>PHA</b>	Process Hazard Analyses
<b>PPE</b>	Personal Protective Equipment
<b>PPM</b>	Parts per million
<b>REL</b>	Recommended Exposure Limit
<b>SEG</b>	Similar Exposure Group
<b>TLV</b>	Threshold Limit Value
<b>TWA</b>	Time-Weighted Average
<b>WFF</b>	Wallops Flight Facility

**DIRECTIVE NO.** GPR 1840.2B  
**EFFECTIVE DATE:** February 27, 2012  
**EXPIRATION DATE:** February 27, 2017

Page 15 of 15

### CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	03/30/2007	Initial Release
A	11/10/2010	Administratively Revised to update the Responsible Office Code, Organization Title and organization name within the document.
B	02/27/2012	Revised with minor updates to referenced forms and directives.

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